CLAIMS

1. A gas inlet manifold for a plasma chamber, comprising:

a back wall perforated by a gas inlet orifice;

a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the gas distribution plate is spaced away from the back wall; and

a suspension having a first end, a second end, and at least one flexible portion between the first and second ends, wherein

the first end is mounted so as to abut the back wall,

the second end is mounted to the gas distribution plate, and

the suspension encircles a region within the gas inlet manifold extending between the back wall and the gas distribution plate, wherein the gas inlet orifices and the gas outlet orifices are in fluid communication with said region.

2. A manifold according to claim 1, wherein:

the at least one flexible portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to impose a substantial thermal resistance between the back wall and the gas distribution plate.

3. A manifold according to claim 1, wherein:

the at least one flexible portion of the suspension has a flexibility sufficient to permit bending the suspension by at least 1.7 degrees without substantial force.

4. A manifold according to claim 1, wherein:

no substantial force is required to bend the suspension sufficiently to permit the gas distribution plate to expand by one percent.

5. A manifold according to claim 1, wherein:

the suspension is capable of bending in response to a force; and

the force required to bend the suspension sufficiently to permit the gas distribution plate to expand by one percent is low enough so that said force does not distort the gas distribution plate.

6. A manifold according to claim 1, wherein:

the gas distribution plate has a flat surface facing outward of the gas inlet manifold that is perforated by the gas outlet orifices;

the suspension is capable of bending in response to a force; and

the force required to bend the suspension sufficiently to permit the gas distribution plate to expand by one percent is low enough so that said force does not distort the flatness of said flat surface by more than 0.1 mm.

7. A manifold according to claim 1, wherein:

the gas distribution plate has a surface facing outward of the gas inlet manifold that is perforated by the gas outlet orifices;

the suspension is capable of bending in response to a force; and

the force required to bend the suspension sufficiently to permit the gas distribution plate to expand by one percent is low enough so that said force does not distort the surface of the gas distribution plate by more than 0.1 mm in a direction perpendicular to the surface.

8. A manifold according to claim 7, wherein:

the force required to bend the suspension sufficiently to permit the gas distribution plate to expand by one percent is low enough so that said force does not distort the surface of the gas distribution plate by more than 0.025 mm in a direction perpendicular to the surface.

9. A manifold according to claim 7, wherein:

the force required to bend the suspension sufficiently to permit the gas distribution plate to expand by one percent is low enough so that said force does not distort the surface of the gas distribution plate by more than 0.01 mm in a direction perpendicular to the surface.

10. A manifold according to claim 1, wherein:

the back wall has a surface facing the gas distribution plate that is generally rectangular with four sides;

the gas distribution plate has a surface facing the back wall that is generally rectangular with four sides;

the suspension comprises four generally rectangular sheets, wherein each of the four sheets extends between a corresponding one of the sides of said surface of the back wall and a corresponding one of the sides of said surface of the gas distribution plate.

11. A manifold according to claim 1, wherein the suspension consists of a single piece of sheet metal.

12. A manifold according to claim 11, wherein:

the gas distribution plate and the suspension each have a circular transverse cross section.

13. A manifold according to claim 1, wherein:

the suspension includes first and second segments separated by a gap that extends between the back wall and the gas distribution plate; and

the manifold further comprises a cover having two parallel members joined by a transverse member, the cover being positioned so that the gap is between the two parallel members and so that the two parallel members are immediately adjacent opposite sides of the suspension.

14. A manifold according to claim 13, wherein:

the gas distribution plate is generally planar;

the first wall has a generally planar surface that faces, and is parallel to, the gas distribution plate; and

said gap occupies an elongated region that is generally perpendicular to said surface of the first wall and that is generally perpendicular to the gas distribution plate.

15. A manifold according to claim 1, further comprising:

a sealing flange having an inner member and an outer member joined together along an elongated junction that bisects both the inner member and the outer member;

wherein the suspension includes first and second segments separated by a gap that extends between the back wall and the gas distribution plate; and

wherein the sealing flange is positioned so that the junction of the sealing flange is within the gap and so that the first and second segments of the suspension are between the inner and outer members of the sealing flange.

16. A plasma chamber comprising:

a chamber wall;

an inlet manifold back wall attached to the chamber wall, wherein the inlet manifold is perforated by a gas inlet orifice;

a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the gas distribution plate is positioned within the plasma chamber and spaced away from the inlet manifold back wall; and

a suspension having a first end, a second end, and at least one flexible portion between the first and second ends, wherein

the first end is mounted so as to abut the back wall,

the second end is mounted to the gas distribution plate, and

the suspension encircles an inlet manifold region extending between the inlet manifold back wall and the gas distribution plate, wherein the gas inlet orifices and the gas outlet orifices are in fluid communication with said region.

17. A chamber according to claim 16, further comprising:

a source of gas connected to supply gas to the gas inlet orifice, so that the gas flows through the gas inlet orifice into said inlet manifold region, then through the orifices in the gas distribution plate into an interior region of the chamber;

wherein said chamber wall encircles said interior region of the chamber.

18. A chamber according to claim 16, wherein:

the at least one flexible portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to produce a substantial temperature differential between the inlet manifold back wall and the gas distribution plate when plasma processing is performed in the chamber.

19. A chamber according to claim 16, wherein:

the at least one flexible portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to produce a temperature differential of at least 100 degrees C between the inlet manifold back wall and the gas distribution plate when plasma processing is performed in the chamber.

20. A chamber according to claim 16, further comprising:

an O-ring seal between the inlet manifold back wall and the chamber wall;

wherein the at least one flexible portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to produce a temperature differential of at least 100 degrees C between the O-ring seal and the gas distribution plate when plasma processing is performed in the chamber.

21. A chamber according to claim 16, further comprising:

an O-ring seal between the inlet manifold back wall and the chamber wall; and

a heat sink that is thermally coupled to the inlet manifold back wall so as to prevent the O-ring from having a temperature exceeding 100 degrees C;

wherein the at least one flexible portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, so that the gas distribution plate has a temperature of at least 200 degrees C when plasma processing is performed in the chamber.

22. A chamber according to claim 16, wherein:

the at least one flexible portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, so that the gas distribution plate has a temperature of at least 200

degrees C when plasma processing is performed in the chamber.

23. A chamber according to claim 16, further comprising:

an RF power supply; and

an RF cable having first and second ends, the first end of the RF cable being connected to the RF power supply; and

an annular sealing material positioned so as to abut a surface of the first end of the suspension and so as to encircle an inner portion of said surface so as to seal said inner portion from ambient atmospheric pressure;

wherein the second end of the RF cable is directly connected to the first end of the suspension at a point radially outward of said annular sealing material.

24. A chamber according to claim 23, wherein:

the annular sealing material is positioned between the back wall and said surface of the first end of the suspension so as to abut the back wall.

25. A chamber according to claim 16, further comprising:

an RF power supply; and

an RF cable having first and second ends, the first end of the RF cable being connected to the RF power supply, and the second end of the RF cable being connected directly to the inlet manifold back wall;

wherein said attachment between the inlet manifold back wall and the suspension provides an RF electrical connection between the inlet manifold back wall and the suspension.

26. A chamber according to claim 25, further comprising:

a first annular sealing material positioned so as to abut a surface of the inlet manifold back wall and so as to encircle an inner portion of said surface so as to seal said inner portion from ambient atmospheric pressure;

wherein said first end of the suspension is attached to said inner portion of the inlet manifold

back wall and is not attached to any other portion of the inlet manifold back wall.

27. A chamber according to claim 26, further comprising:

an annular dielectric material positioned between said surface of the inlet manifold back wall and the chamber wall so that the first annular sealing material is between the annular dielectric material and the back wall; and

a second annular sealing material positioned between the annular dielectric material and the chamber wall.

28. A plasma chamber comprising:

a chamber wall;

an inlet manifold back wall attached to the chamber wall, wherein the inlet manifold is perforated by a gas inlet orifice;

a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the gas distribution plate is positioned within the plasma chamber and spaced away from the inlet manifold back wall; and

a suspension having a first end and a second end, wherein

the first end is mounted to the chamber wall so as to abut the inlet manifold back wall,

the second end is mounted to the gas distribution plate, and

the suspension encircles an inlet manifold region extending between the inlet manifold back wall and the gas distribution plate, wherein the gas inlet orifices and the gas outlet orifices are in fluid communication with said region;

wherein the suspension interposes a substantial thermal resistance between the chamber wall and the gas distribution plate.

29. A chamber according to claim 28, wherein:

the suspension contacts the gas distribution plate at an area that is small enough to interpose substantial thermal resistance between the suspension and the gas distribution plate.

30. A chamber according to claim 28, wherein:

the first end of the suspension contacts the chamber wall at an area that is small enough to interpose substantial thermal resistance between the suspension and the chamber wall.

31. A chamber according to claim 28, wherein:

at least one portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to produce a substantial temperature differential between the chamber wall and the gas distribution plate when plasma processing is performed in the chamber.

32. A chamber according to claim 28, wherein:

at least one portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to produce a temperature differential of at least 100 degrees C between the chamber wall and the gas distribution plate when plasma processing is performed in the chamber.

33. A chamber according to claim 28, further comprising:

an O-ring seal between the inlet manifold back wall and the chamber wall;

wherein at least one portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, to produce a temperature differential of at least 100 degrees C between the O-ring seal and the gas distribution plate when plasma processing is performed in the chamber.

34. A chamber according to claim 28, further comprising:

an O-ring seal between the inlet manifold back wall and the chamber wall; and

a heat sink that is thermally coupled to the inlet manifold back wall so as to prevent the O-ring from having a temperature exceeding 100 degrees C;

wherein at least one portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, so that the gas distribution plate has a temperature of at least 200 degrees C when plasma processing is performed in the chamber.

35. A chamber according to claim 28, wherein:

at least one portion of the suspension has a thickness that is sufficiently small, and a height that is sufficiently large, so that the gas distribution plate has a temperature of at least 200 degrees C when plasma processing is performed in the chamber.

36. A method of minimizing thermal stress on a gas distribution plate through which gas is dispensed into the interior of a plasma chamber, comprising the steps of:

providing a plasma chamber having an interior encircled by a chamber wall;

providing an inlet manifold side wall having a first end, a second end, and at least one flexible portion between the first and second ends;

positioning the inlet manifold side wall within the plasma chamber so as to encircle an inlet manifold region within the plasma chamber;

mounting the first end of the inlet manifold side wall within the chamber;

mounting an inlet manifold back wall so as to abut the first end of the inlet manifold side wall;

mounting the second end of the inlet manifold side wall to a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the inlet manifold back wall, the inlet manifold side wall, and the gas distribution plate collectively enclose said inlet manifold region; and

supplying a gas through an aperture in the inlet manifold back wall so that the gas flows into the inlet manifold region and then flows through the gas outlet orifices into the interior of the plasma chamber.

37. A method according to claim 36, further comprising the step of:

producing within the interior of the plasma chamber a plasma that radiates heat;

wherein the step of providing the inlet manifold side wall includes the step of providing the at least one flexible portion of the inlet manifold side wall with a thickness sufficiently small, and an axial height sufficiently large, so as to produce a substantial temperature differential between the inlet manifold back wall and the gas distribution plate in response to the heat radiated by the plasma.

38. A method according to claim 37, wherein said temperature differential is at least 100 degrees C.

39. A method according to claim 36, wherein the step of providing the inlet manifold side wall includes the step of:

providing the at least one flexible portion of the inlet manifold side wall with a flexibility sufficient so that no substantial force is required to bend the inlet manifold side wall by an amount sufficient to permit the gas distribution plate to expand by at least one percent.

40. A method of elevating the temperature of a gas distribution plate while dispensing a gas into the interior of a plasma chamber, comprising the steps of:

providing a plasma chamber having an interior encircled by a chamber wall;

mounting a gas inlet manifold within the chamber, including the steps of

providing within the plasma chamber an inlet manifold side wall having a first end and a second end,

positioning the inlet manifold side wall within the plasma chamber so as to encircle an inlet manifold region within the plasma chamber,

mounting the first end of the inlet manifold side wall to the chamber wall so that an area of the chamber wall contacts said first end,

mounting an inlet manifold back wall so as to abut the first end of the inlet manifold side wall, and

mounting a gas distribution plate perforated by a plurality of gas outlet orifices to the second end of the inlet manifold side wall so that an area of the gas distribution plate contacts said second end,

wherein the inlet manifold back wall, the inlet manifold side wall, and the gas distribution plate collectively enclose said inlet manifold region; and

supplying a gas through an aperture in the inlet manifold back wall so that the gas flows into the inlet manifold region and then flows through the gas outlet orifices into the interior of the plasma chamber;

wherein the step of mounting the gas inlet manifold further comprises interposing substantial thermal impedance between said area of the chamber wall and said area of the gas distribution plate.